

Algebra – Properties of Exponents

1. Zero Exponents

$$a^0 = 1$$

examples: $x^0 = 1$ $100^0 = 1$ $5xyz^0 = 5xy$ $(5xyz)^0 = 1$

2. Negative Exponents

$$x^{-n} = \frac{1}{x^n}$$

examples: $10^{-2} = \frac{1}{10^2} = \frac{1}{100}$ $\frac{5x^{-1}y^5z^{-5}}{2a^{10}b^{-4}c^2} = \frac{5y^5b^4}{2a^{10}c^2x^1z^5}$

3. Multiplying Powers with the Same Base

$$a^m \cdot a^n = a^{m+n}$$

examples: $2^2 \cdot 2^3 = 2^{2+3} = 2^5 = 32$ $x^{10} \cdot x^5 = x^{10+5} = x^{15}$

4. Raising a Power to a Power

$$(a^m)^n = a^{mn}$$

examples: $(a^5)^2 = a^{5(2)} = a^{10}$ $(2^2)^{-3} = 2^{2(-3)} = 2^{-6} = \frac{1}{2^6} = \frac{1}{64}$

5. Raising a Product to a Power

$$(ab)^n = a^n \cdot b^n$$

examples: $(2x^2)^3 = 2^3x^6 = 8x^6$ $(2x^2)^{-3} = 2^{-3}x^{-6} = \frac{1}{2^3x^6} = \frac{1}{8x^6}$

6. Dividing Powers with the Same Base

$$\frac{a^m}{a^n} = a^{m-n}$$

example: $\frac{5^3}{5^5} = 5^{3-5} = 5^{-2} = \frac{1}{5^2} = \frac{1}{25}$

7. Raising a Quotient to a Power

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

examples: $\left(\frac{x^5}{y^2}\right)^3 = \frac{x^{15}}{y^6}$ $\left(\frac{2^3}{4}\right)^2 = \frac{2^6}{4^2} = \frac{64}{16} = 4$